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TRADE POLICY UNDER ENDOGENOUS CREDIBILITY

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Abstract

Because trade liberalization which is anticipated to be temporary creates a divergence between the effective domestic rate of interest and the world rate of interest, tariff reduction in the presence of international financial asset trade may reduce welfare for a small country. Calvo has argued that even though the government intends to liberalize trade permanently, if the private sector believes with some probability that a tariff will be imposed in the future, then free trade may not be optimal. This paper first formalizes this argument and discusses the optimal policy for a government which seeks to maximize representative household welfare. The government's lack of credibility is represented by a set of beliefs the private sector holds about the type of government it faces. Next, beliefs are endogenized by allowing the private sector to update them using Bayes' rule. In one approach, the true government's objective is maximize welfare for the economy, so that it does not seek to imitate another type, in contrast with other recent models of policy credibility. With learning, the government eventually adopts free trade, even though restricted trade is optimal initially.

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1. Introduction

Trade liberalization which is anticipated to be temporary creates a difference between the effective domestic rate of interest and the world rate of interest. In some recent papers, Calvo (1985, 1986b) has demonstrated the second-best result that temporary trade liberalization, even in the absence of market power or distortions, may reduce welfare for a small country. (Froot (1986) demonstrates a similar result.) Because a tariff will be reimposed in the future, there is an intertemporal distortion when financial assets can be traded internationally which may dominate the welfare-increasing effects of temporary tariff reduction.

In another paper, Calvo (1986a) has argued that even though the government intends to liberalize trade permanently, if the private sector believes with some probability that a tariff will be imposed in the future, then free trade may not be optimal. Calvo takes the beliefs of the private sector as given exogenously.

In this paper we first formalize Calvo's argument and discuss the optimal policy for a government which seeks to maximize a representative household's welfare. The government's lack of credibility with the private sector is represented by a set of beliefs which the household holds about the type of government it faces. The households perceive the possibility of two types of governments, one of which is the true one. We assume that there is a single false type, which is believed to select a tariff with a positive probability.

Households choose their consumption and saving plans to maximize expected utility, where the expectation is taken over the policies of the two types of governments, given their prior beliefs about the probabilities of which type they face. The true government also maximizes household expected utility; however, it knows its type, so that the expectation is taken using this information. The government would ideally always choose free trade. Because their policy objectives are incredible, tariff imposition (i.e., non-liberalization) may lead to a higher level of household utility than free trade.

We next endogenize learning by allowing the private sector to update its beliefs using Bayes' rule. Our approach is somewhat similar to that taken by Backus and Driffill (1985,1986), Barro and Gordon (1983), and Barro (1986) in their analyses of monetary policy. However, in our model the true government's objective is to maximize welfare for the economy rather than some arbitrary function. Furthermore, the true government does not increase its payoff by imitating another type -- our equilibrium is not the Kreps-Wilson reputational type. The true government's payoff is greater the larger is the probability perceived by the private sector that they face the true type. In the presence of learning, Calvo's case for non-liberalization is much weaker. If a government is committed to maximizing welfare, then we show first that with learning, the private sector must be more skeptical initially (than without learning) for a tariff to be superior to free trade. We also show that there is an upper bound on the number of periods in which a tariff will be chosen by the welfare maximizing government.

Section 2 presents a simple two-period model with a single consumption good. Calvo's argument is developed in the absence of learning. Learning

about the government's type is introduced in section 3. In the single consumable model, there are no atemporal effects of trade policy. Section 4 adds a second consumption good and a static welfare gain from free trade. The model is also extended beyond two time periods. Section 5 concludes.

2. A Two-Period Model Without Learning

The effects of private sector incredibility about the objectives of the government are introduced in a simple two-period model of a small open economy. There is a single imported consumption good, which is not produced at home, and an export good (manna) which is not used domestically and is available in an exogenously fixed supply each period. The private sector is represented by a single household which maximizes the expectation of a discounted sum of utility of current consumption. The discount rate is constant and equal to the world rate of interest.

The government's only role is to set trade policy and redistribute any tariff revenue in a lump-sum fashion. The government seeks to maximize the welfare of the representative household. However the government lacks credibility with the private sector: the household believes that the government is the true welfare-maximizing one with positive probability less than unity. For simplicity, we assume that the household believes the only alternative possibility is a government which adopts the rule: impose a tariff next period with probability q, or choose free trade for the next period with probability (1-q).

Because we will introduce learning by the household about the

government's true type, we restrict the policies which can be chosen in any period to a finite set. Otherwise, if the government selects a policy which has zero probability of being chosen by the alternative government, then the government's type will be fully revealed. For simplicity only two policies are assumed to be available -- free trade or a fixed positive tariff rate. Furthermore, taxes on foreign borrowing or capital controls are unavailable (see below).

The export good is chosen as numeraire. The representative household's utility is given by:

$$U(c_1,c_2) = V(c_1) + \beta E(V(c_2)),$$

where c_1 and c_2 are consumption in periods 1 and 2, respectively. V(c) is twice continously differentiable, increasing and concave and β is the discount factor. V' (c) approaches infinity as consumption falls to zero and approaches zero as consumption rises toward infinity. The expectation is taken over the beliefs of the household about the government's type and respective behavior in period 2.

The household has access to an international capital market, in which it can borrow or lend at given rate of interest, r. Any debt incurred in period 1 must be repaid in full in period 2. We assume that the household's rate of discount equals the world rate of interest, so that $\beta = (1+r)^{-1}$. Units for the importables and exportables are chosen so that their free trade price is unity and the relative price of the import in terms of the export cum tariff is $p > 1$.

The household solves

$$\max_{c_1,x,\bar{c}_2,c_2} \{V(c_1) + \beta[\pi V(\bar{c}_2) + (1-\pi)V(c_2)]\}$$

subject to

$$p_1 c_1 \leq y + x + R_1,$$

$$p\bar{c}_2 \leq y - (1+r)x + R_2,$$

and

$$c_2 \leq y - (1+r)x,$$

where π is the subjective probability that the tariff will be imposed in period 2, p_1 is the relative price of the import good in period 1, and R_1 and R_2 are the lump-sum transfers of period 1 and period 2 tariff revenue, respectively. If p_1 is one, then R_1 is zero. Planned consumption in period 2 is given by $\bar{c}_2$ in the event a tariff is imposed in the second period and by c_2 in the event of free trade in the second period. The first period current account deficit is given by x, and y is the amount of manna available each period.

The household equilibrium conditions are:

(1) $$V'(c_1)\cdot(1/p_1) = \pi\, V'(\bar{c}_2)\cdot(1/p) + (1-\pi)V'(c_2),$$

(2) $$c_1 + c_2/(1+r) = y(1 + 1/(1+r)), \text{ and}$$

(3) $$c_2 = \bar{c}_2 .$$

The equilibrium conditions $R_1 = (p_1-1)c_1$ and $R_2 = (p-1)\bar{c}_2$ have been used in the second and third equations.

The government chooses trade policy in each period to maximize household welfare, which is expected utility. However, the government knows its true type, so that its objective function is

$$W = V(c_1) + \beta V(c_2).$$

In the second period, the true government is indifferent between free trade and a tariff because there is no static tariff distortion in this special

model. There are only intertemporal distortions in the presence of international asset trading induced by the government's lack of credibility. We will assume that the true government always chooses free trade in period 2, because this choice would always be optimal in the last period for a small country if there were multiple consumption goods. The subjective probability that the tariff is imposed in period 2, π, is the product of the probability that the false government imposes the tariff, q, and the perceived probability that the government is the false type, $(1-\lambda)$.

The true government's problem is to choose p, from the set {1,p} to maximize the value of W, given the resultant expected utility maximizing consumption behavior of the household. Equation (1) implies that if π exceeds zero and free trade is selected in the first period, then consumption in period 1 exceeds y and consumption in period 2 is less than y. That is, the country borrows from abroad since the effective market rate of interest faced by the household is less than the world rate of interest.

If π is zero, then free trade in the first period ($p_1 = 1$) achieves the first-best allocation of consumption over periods, and if π is unity then the tariff achieves the first-best. In both these cases, the intertemporal terms of trade for the household are identical to the foreign terms, (1+r), so that there is no intertemporal distortion and consumption is the same in each period. When π is between zero and one, there is a welfare loss due to the intertemporal distortion created by the government's lack of credibility under either free trade of the tariff.

In this model, any policy which brings the effective rate of interest for households into equality with the world rate of interest eliminates the intertemporal distortion and achieves the first-best outcome. One such policy

is an intermediate tariff which yields a domestic relative price of the importable between one and p. However, our motivation is the problem of trade liberalization when the private sector is skeptical about the government's resolve to stay with the liberal regime. If the private sector assesses probability π to a return to the old status quo and probability $1-\pi$ that whatever liberalized regime is chosen will be maintained, then our set-up is a simple representation of the optimizing government's problem. The two possibilities perceived by households are simply normalized to yield relative prices, 1 or p. Therefore, we exclude the possibility that the true government can select a tariff rate other than one of the two rates the false government might select.

Other policies which alleviate the intertemporal distortion are capital controls, as noted by Calvo (1985). An optimal policy is to impose a tax on foreign borrowing (lending) along with free trade (tariff), so that consumption is just equal across periods. In the presence of a static distortion under a tariff (substitution in production or consumption), free trade and a tax on foreign borrowing of the appropriate magnitude can achieve a first-best allocation. For the remainder of this paper, we assume that capital controls are infeasible, or that taxes on international asset transactions can be evaded.

The government chooses between free trade and the tariff to maximize household utility, cognizant of how the household subsequently consumes and saves. The value of social welfare in the case of free trade in the absence of learning is given by a function of the household's prior beliefs, π:

$$W_1(\pi) = V(c_1) + \beta V(c_2) \tag{4}$$

such that

(5) $$V'(c_1) = \varphi \cdot V'(c_2), \text{ and}$$

(6) $$c_1 + (1+r)^{-1}c_2 = y(1 + (1+r)^{-1}), \text{ where}$$

$$\varphi \equiv \pi(1/p) + (1-\pi).$$

The function φ is the ratio of the world market discount factor to the domestic effective discount factor and is always less than or equal to one. $W_1(\pi)$ achieves a maximum for π equal to zero and is monotonically decreasing in π. To see this, note that differentiation of equations (4), (5) and (6) yields:

$$dW_1/d\pi = [V'(c_1)-V'(c_2)]V'(c_2)((1/p)-1)/[V''(c_1) + V''(c_2)(1+r)\varphi].$$

Equation (5) implies that $V'(c_1) < V'(c_2)$, so that, with strict concavity of $V(c)$, $dW_1/d\pi < 0$, for all $\pi > 0$.

Social welfare when the tariff is imposed is given by:

(7) $$W_p(\pi) = V(c_1) + \beta V(c_2)$$

such that

(8) $$V'(c_1) = p \cdot \varphi \cdot V'(c_2), \text{ and}$$

(9) $$c_1 + (1+r)^{-1}c_2 = y(1 + (1+r)^{-1}),$$

where $p \geq p\cdot\varphi \geq 1$. $W_p(\pi)$ achieves a maximum when π equals one and is monotonically increasing in π. This is derived from differentiation of equations (7), (8) and (9) which yield

$$dW_p/d\pi = [V'(c_1)-V'(c_2)]V'(c_2)(1-p)/[V''(c_1)+V''(c_2)(1+r)p\varphi].$$

Since in this case (8) implies that $V'(c_1) > V'(c_2)$, $dW_p/d\pi > 0$, for all $\pi < 1$.

The values of social welfare are depicted in Figure 1 for both the free trade and tariff cases. The value of π, π^*, such that the two are equal is greater than one-half. To see this, first note that since the rate of time

preference equals the interest rate, and utility is concave, the farther c_1 or c_2 deviate from $c_1 = c_2 = y$, the lower is social welfare. When free trade is chosen in the first period by the government, $c_1 > y$ and there is dissaving, while $c_2 < y$. Let us call the choice of consumption in the first period under free trade c', and the choice of consumption in the second period under free (first period) trade c^*. From the first order conditions, $V'(c') = (1/2)(1+(1/p))V'(c^*)$. When a tariff is chosen in the first period, then $c_1 < y$ and $c_2 > y$. Note that if c^* were consumed in the first period, and c' were consumed in the second period, that the first-order conditions would not be satisfied. It would be the case that $V'(c^*) < (1/2)(1+p)V'(c') = (1/4)(1+p)(1+(1/p))V'(c^*)$ because $(1+p)(1+(1/p))(1/4) > 1$. Therefore, it is the case that the first period consumption is less than c^* (because utility is concave, a lower first-period consumption is needed to achieve the first-order condition). Hence, when the tariff is imposed at $\pi = 1/2$, the consumption bundle is farther from the optimum and welfare is lower. Thus at $\pi = 1/2$, $W_1 > W_p$ and the intersection must occur to the right of one-half.

If the private sector's beliefs in period 1 are that the joint probability of the government being false and imposing a tariff in period 2 is greater than π^*, then the true optimizing government will impose a tariff in the first period. Otherwise, free trade in the first period will be optimal. In the case that q is less than one-half, free trade will be optimal in period 1 for all prior subjective probabilities that the government is the true type.

Example: Let utility display constant relative risk aversion with the coefficient of relative risk aversion equal to two:

$$V(c) = -c^{-1}.$$

In this case, $W_1(\pi^*) = W_p(\pi^*)$ implies that $\pi^* = \frac{\sqrt{p}}{\sqrt{p}+1}$, where p is the domestic price-cum-tariff of the consumable. For all $\pi > \pi^*$, $W_1(\pi) < W_p(\pi)$, and for all $\pi < \pi^*$, $W_1(\pi) > W_p(\pi)$.

3. Two-Period, Single Consumable Model with Learning

We now introduce learning by the private sector about the government's type using Bayes' Rule. The household updates its beliefs about the type of government given the observation that if the government is the true one, it has acted optimally in the first period. The updating rules given that free trade or a tariff is optimal for the true government are straightforward. We assume that the government knows the household's prior beliefs and that the household recognizes that the true government chooses between the tariff and free trade optimally given the posteriors that will be formed by the household.

If the parameters of the economy are such that a tariff is optimal for the first period, then the prior probability that a tariff is imposed in period 1 is given by

$$q(1-\lambda_0) + \lambda_0,$$

where λ_0 is the prior probability that the government is the true type. This prior comes from the facts that true government chooses a tariff with probability one (because we are talking about the case in which a tariff is optimal) and the false government chooses a tariff with probability q (it has the same probability of choosing a tariff in period 1 and period 2). Using Bayes' rule, the posterior that the government is the true one once it is

revealed that there is a tariff in place in period 1 is

$$\bar{\lambda}_1 = \lambda_0/[q(1-\lambda_0) + \lambda_0].$$

Therefore, the posterior π, the subjective probability that a tariff will be imposed in period 2, in this case is

$$\bar{\pi}_1 = q(1-\bar{\lambda}_1) = q^2\pi_0/[q - (1-q)\pi_0],$$

where π_0 was the prior probability of a tariff in period 2 (the subjective probability of a tariff in period 2 before the tariff in period 1 was revealed $= q(1-\lambda_0)$). This is because the probability that the true government will impose a tariff in the second period is zero, while the probability that the false one will is q.

In other words, households know what the true government would do if it were in power. They know the parameters of the model, so they know if a tariff is the optimal choice by the true government if it is in power. In this case it is optimal to put on a tariff. Prior to observing the tariff that is actually chosen by the true government, households have some prior probability that the true government is in power. After it is revealed that a tariff is imposed in period 1, they update their priors. Consumption decisions are made in period 1 after the tariff is revealed. Because the (true) government has full information, they make their tariff choice in period 1 knowing how consumers will update their priors.

If the parameters of the economy are such that free trade is optimal in period 1, then the prior probability that free trade will be observed is

$$(1-q)(1-\lambda_0) + \lambda_0.$$

The posterior probability that the government is the true one, after having observed free trade in period 1 is

$$\hat{\lambda}_1 = \lambda_0/[(1-q)(1-\lambda_0) + \lambda_0].$$

Therefore, the posterior π, the subjective probability of a tariff being imposed in period 2, in this case is

$$\hat{\pi}_1 = q(1-\hat{\lambda}_1) = (1-q)\pi_0/(1-\pi_0).$$

For $0 < \pi_0 < q$, both $\bar{\pi}_1$ and $\hat{\pi}_1$ are less than π_0. Note that $\bar{\pi}_1 \neq \hat{\pi}_1$ for a given prior π_0, as long as λ_0 exceeds zero.

There will be a prior π_0, call it $\tilde{\pi}$, that gives rise to posteriors such that $W_1(\hat{\pi}) = W_p(\bar{\pi})$. This is the point where the government is just indifferent between putting on a tariff or not. For greater prior probabilities of a tariff it will definitely put on a tariff, and for lesser prior probabilities it will definitely not put on a tariff. The following proposition shows that $\tilde{\pi} > \pi^*$. That is, the prior probability that makes them indifferent between putting on a tariff and not with learning is greater than the prior probability that made them indifferent without learning. Hence, with learning, the household has to be initially more skeptical before the government is induced to put on a tariff in period 1.

Proposition 1: If $0 < \lambda_0 < 1$, the prior $\tilde{\pi}$ such $W_1(\hat{\pi}) = W_p(\bar{\pi})$ exceeds the prior π^*such that $W_1(\pi^*) = W_p(\pi^*)$ in the absence of learning.

Proof: If $W_1(\hat{\pi}) = W_p(\bar{\pi})$, it is not the case that $\hat{\pi} = \bar{\pi} = \pi^*$. $\hat{\pi} = \bar{\pi}$ only when $q = 1/2$, but as mentioned above, when $\pi = \pi^*$, $q > 1/2$.

When $\pi \neq \pi^*$, then $\max (W_1, W_p) > W_1(\pi^*) = W_p(\pi^*)$. By the monotonicity of W_1 and W_p, if $\pi < \pi^*$, then $W_1 > W(\pi^*)$ (the common value of $W_1(\pi^*)$ and $W_p(\pi^*)$) and a zero tariff would be chosen and if $\pi > \pi^*$, then $W_p > W(\pi^*)$ and a tariff would be chosen in period 1.

Hence at the posteriors $\hat{\pi}$ and $\bar{\pi}$ such that $W_1(\hat{\pi}) = W_p(\bar{\pi})$ both are greater than $W(\pi^*)$. In particular, $W_p(\bar{\pi}) > W(\pi^*)$, which from monotonicity implies $\bar{\pi} > \pi^*$. Since $\tilde{\pi} > \bar{\pi}$, $\tilde{\pi} > \pi^*$.

4. Model with Two Consumption Goods

In the model of the previous sections, there was no atemporal distortion created by tariffs. The only distortion was in the saving behavior of the household . This arose because the household was dubious about the motives of the government and perceived a possible change in trade policy in the next period. Extension of the model to include a static distortion in consumption from the tariff is possible. In such a case, the true government will always choose free trade in the last period. For positive values of π, tariff imposition in the first period can partially offset the intertemporal distortion. However, it also introduces an additional atemporal welfare reduction. In the one good case, there always exist possible priors for which choosing the tariff in the first period is superior to free trade (e.g., $\pi = 1$). When there are two consumption goods, free trade may or may not be a superior policy for all prior beliefs.

Adding a second consumable to our two-period model is straightforward. For simplicity, the country is completely specialized in production of the export good, which is taken as numeraire. Output of the exportable is exogenous and constant, and both the importable and exportable are consumed. Household utility is again intertemporally separable, and the discount rate is equal to the given world rate of interest. We write the utility of current consumption in indirect form and assume that units are chosen so that the

world relative price of the importable is unity.

Because free trade will always be chosen by the true government in the second period, social welfare under time-consistent policy is given by:

$$W = V(p_1, I_1) + \beta V(1, z_2),$$

where I_1 is consumption expenditure in period 1 valued at domestic price p_1, and z_2 is consumption expenditure in period 2 valued at the world (and true domestic) price, one.

The representative household maximizes expected utility, given prior beliefs summarized by π. The first-order conditions for maximization yield

$$\frac{\partial V(p_1, I_1)}{\partial I_1} = (1-\pi)\frac{\partial V(1, z_2)}{\partial z_2} + \pi \frac{\partial V(p, I_2)}{\partial I_2},$$

$$I_1 = y + x + R_1,$$

$$z_2 = y - (1+r)x, \text{ and}$$

$$I_2 = y - (1+r)x + R_2,$$

where $R_1 = (p_1 - 1)c_1^2$ and $R_2 = (p - 1)c_2^2$, in equilibrium. Planned consumption of good 2 in period 2 in the event of a tariff in period 2 is equal to c_2^2. The superscript refers to the second good. I_2 is consumption expenditure valued at domestic prices if there were a tariff. The current account deficit in period 1 is given by x.

We now assume that the utility from current period consumption is homothetic and displays constant relative risk aversion. Indirect utility in each period is given by:

$$V(p, I) = \frac{(\nu(p)I)^{1-\sigma}}{1-\sigma},$$

where $\nu'(p) < 0$ and $\sigma > 0$. Also we define

$$\alpha = (p-1)c^2/I,$$

where the superscript 2 refers to the second good, so that expenditures measured in world prices and measured in domestic prices for the same consumption bundle are related by

$$z = (1-\alpha)I.$$

The first-order conditions for household optimization yield:

$$(10) \qquad (z_2/z_1)^{\sigma} = (1-\pi) + \pi \cdot [\nu(p)/\nu(1)]^{1-\sigma}(1-\alpha)^{\sigma},$$

if $p_1 = 1$ (i.e., free trade is chosen in period 1) and

$$(11) \qquad (z_2/z_1)^{\sigma} = (1-\pi)[\nu(1)/\nu(p)]^{1-\sigma}(1-\alpha)^{-\sigma} + \pi,$$

if $p_1 = p$ (i.e., the tariff is imposed in period 1).

The values of the true government's objective function are:

$$(12) \qquad W_1(\pi) = \frac{(\nu(1)B)^{1-\sigma}}{1-\sigma}\left[1 + \beta\,\varphi_1^{((1-\sigma)/\sigma)}\right]\left[1 + \beta\,\varphi_1^{1/\sigma}\right]^{\sigma-1},$$

for free trade in period 1,

and

$$(13) \qquad W_p(\pi) = \frac{(\nu(1)B)^{1-\sigma}}{1-\sigma}\left[\gamma + \beta\varphi_p^{((1-\sigma)/\sigma)}\right]\left[1 + \beta\varphi_p^{1/\sigma}\right]^{\sigma-1},$$

for the tariff in period 1,

where $\varphi_1 = (z_2/z_1)^{\sigma}$, in the presence of free trade,

$\varphi_p = (z_2/z_1)^{\sigma}$, in the presence of the tariff,

$\gamma \equiv [(\nu(p)/(1-\alpha)\nu(1)]^{1-\sigma}$, and $B \equiv y(1 + (1+r)^{-1})$. We have used the fact

that

$$z_1 = B \cdot (1 + \beta \varphi_i^{1/\sigma})^{-1}, \text{ for } i = 1,p.$$

It is useful to notice that $(\gamma-1)/(1-\sigma)$ is a measure of the atemporal welfare loss from a tariff since this quantity equals

$$[(\nu(p)I)^{1-\sigma} - (\nu(1)z)^{1-\sigma}]/(1-\sigma),$$

which is the difference between the utility for some given level of expenditure measured at world prices when a tariff is in place and when it is not. This quantity must be negative.

For many cases, equations (10) and (11) imply that if π is between zero and one, then expenditure measured at world prices will be less (greater) in period 2 than in period 1 when free trade (the tariff) is adopted in period 1. The possibility exists that the opposite effects occur for particular combinations of tariff magnitude, elasticity of substitution between commodities, and coefficient of relative risk aversion, as long as the latter is greater than unity. In such instances, social welfare with the tariff, $W_p(\pi)$, is monotonically decreasing in π, so that free trade in period 0 is superior to the tariff for all values of π. Therefore, we restrict our attention to cases in which z_1 is greater than z_2 if free trade is adopted in period 1, so that free trade leads to a current account deficit in the first period, as in the one-good model. That is, we restrict attention to cases in which $\gamma(1-\alpha) < 1$. This will always hold if σ is less than one.

$W_1(\pi)$ is monotonically decreasing in π and has a derivative equal to zero for π equal to zero. However, $W_p(\pi)$ has a maximum value for some value of π between zero and one.

Because the static distortion is created by tariffs, free trade may be

superior to the tariff for all prior beliefs about the government's type. If the tariff is superior to free trade for some possible beliefs, then those values of π for which it is the optimal policy all exceed one-half. This follows from the one-good model, since the presence of the atemporal welfare effect can only reduce the benefits of tariff imposition. Figures 2(a) and 2(b) display curves $W_1(\pi)$ and $W_p(\pi)$ for two possible cases.

Proposition 2: The least prior value of $\tilde{\pi}$ between 0 and 1 such that $W_1(\hat{\pi}) = W_2(\bar{\pi})$, if it exists, under Bayesian learning exceeds the prior π^* such that $W_1(\pi^*) = W_2(\pi^*)$ in the absence of learning.

Proof: Because $W_p(\pi)$ is not monotonically increasing in π, the argument for Proposition 1 is insufficient. The possibility arises that $W_1(\hat{\pi}) = W_p(\bar{\pi})$ for values of $\hat{\pi}$ and $\bar{\pi}$ less than π^*. However, if $q > 1/2$, then the Bayesian updating rules imply that $\bar{\pi} > \hat{\pi}$. Whenever $q \leq 1/2$, free trade in the first period is superior to the tariff for the true government (π must be less than 1/2). Since $W_1(\pi) > W_p(\pi)$ for any $\pi < \pi^*$, if $W_1(\pi_1) = W_2(\pi_2)$ for some π_1, $\pi_2 < \pi^*$, then $\pi_1 > \pi_2$. Any other possibility is ruled out because $W_1(\pi)$ is monotonically decreasing. Therefore, $\bar{\pi} > \hat{\pi}$ implies that $\bar{\pi}$ must exceed π^*, and $\tilde{\pi} > \bar{\pi} > \pi^*$.

The two-period model can be extended to an arbitrarily long finite horizon or an infinite horizon model. With learning, each period that the true government chooses its optimal policy, the prior belief that it is the false type is reduced. This is true whether the optimal policy is free trade or tariff imposition in any given period. If tariff imposition is optimal given the initial prior, then, in the absence of learning, it will always be the optimal policy until the last period (or always, if the horizon is

infinite.) However, when the household updates its beliefs about the government's type after observing the policy chosen each period, if the horizon is long enough free trade will eventually become the optimal policy choice. This is true even when the tariff is the best policy in early periods.

The multi-period extension of the model is straightforward. The household maximizes

$$E \sum_{t=0}^{T} \beta^t V(p_t, I_t)$$

with respect to consumption expenditures $\{I_t\}_{t=0}^{T}$, subject to

$$\sum_{t=0}^{T} (I_t/(1+r)^t) \leq \sum_{t=0}^{T} ((R_t + y)/(1+r)^t),$$

where $R_t \equiv (p_t - 1) \cdot c_2^t$ and $\beta \equiv (1-r)^{-1}$. The expectation is taken with respect to the sequence of domestic relative prices, $\{p_t\}_{t=0}^{T}$, which are random variables for the incredulous household. The household knows the objective of the true government (but assesses less than probability one to the government being this type), so that it can calculate the path of policies chosen by both the true type and false type recognizing how its own beliefs will be updated.

At time τ, the true government's objective is given by

$$W^{\tau} = \sum_{t=\tau}^{T} \beta^t V(p_t, I_t),$$

where I_t is the actual consumption expenditure of the household given the policies chosen. The government selects a policy sequence, $\{p_t\}_{t=0}^{T}$, which is the optimal time consistent one given the updating rules and initial (time 0)

priors of the private sector. The horizon T can be infinity.

The Bayesian updating rules are unchanged. Each period that the true government chooses the policy which is optimal, the prior belief, λ, of the household that it is the true type rises. For a given initial prior, λ_0, greater than zero, the number of periods for the prior, λ_t, to decline to any value less than unity is finite. Therefore, even if the tariff is optimal initially, for a large enough T, free trade will become a superior policy in a bounded number of periods and it will be selected thereafter. This is summarized as:

Proposition 3 For the infinite horizon problem, if $\lambda_0 > 0$, the number of periods such that the tariff is the optimal policy is bounded by a finite number K. K will depend upon the parameters of the model.

Proof If $\pi_0 = (1-\lambda_0)q$ is zero, then the first-best is achieved by the policy sequence, $\{p_t = 1\}_{t=0}^{\infty}$. Let $q > 0$, and denote the value of social welfare under this policy of free trade as a function of λ_0, $W(\lambda_0)$. Furthermore, for any alternative policy sequence, $\{\bar{p}_t\}_{t=0}^{\infty}$, such that $\exists\ t < \infty$ for which $\bar{p}_t = p$, the value of social welfare $\bar{W}(\lambda_0)$ is strictly less than $W(\lambda_0)$ for $\lambda_0 = 1$. Strict concavity and twice-continuous differentiability of $U(c^1,c^2)$ imply that $W(\lambda_0)$ is continuous in λ_0. Continuity of W therefore implies there exists $\lambda^* < 1$ such that $W(\lambda_0) > \bar{W}(\lambda_0)$ for all $\lambda_0 > \lambda^*$, where the policy generating $\bar{W}$ is $\bar{p}_0 = p$ and $\bar{p}_t = 1$, $\forall\ t \geq 1$. This implies that given $\lambda_t > \lambda^*$, at any time t, the optimal time-consistent policy thereafter is free trade as long as $\lambda_s > \lambda^*$ for all $s \geq t$. This condition holds by the Bayesian updating rules which imply that both $\bar{\lambda}_s$ and $\hat{\lambda}_p$ exceed λ_{s-1}, the prior:

$$\bar{\lambda}_s = \lambda_{s-1}/[q(1 - \lambda_{s-1}) + \lambda_{s-1}], \text{ and}$$

$$\hat{\lambda}_s = \lambda_{s-1}/[(1-q)(1 - \lambda_{s-1}) + \lambda_{s-1}].$$

The dynamic behavior of the current account can be inferred in the normal case we consider (that is, an anticipated future tariff induces a current account deficit). If the tariff is a superior policy given initial prior beliefs, than a current account surplus occurs since there is a perceived positive probability that free trade will be chosen in a subsequent period. As the prior probability that the government is the false type falls with learning, the intertemporal distortion created by the tariff increases and the current account surplus rises. Once free trade becomes optimal, the current account goes into deficit because the private sector perceives a positive probability of a tariff the next period. With learning, this probability declines, so that the current account deficit falls toward zero. Since the optimal saving path followed by the economy depends upon the initial prior beliefs of the household, the steady-state wealth and consumption also depends upon the initial priors.

5. Conclusion

When a government is in power that wishes to maximize the welfare of consumers, but the consumers do not believe that is the government's goal, a distortion is introduced into the economy. In the models we have examined, the misperception is about future tariff policy. The incredulity of households creates an intertemporal distortion.

A first-best policy to remove this distortion -- such as a tax on foreign

borrowing -- is not available to the government. As a second-best policy it may be desirable to impose a tariff, if the atemporal distortion is smaller than the intertemporal distortion.

The optimizing government cannot reach the first-best solution under the constraints we have postulated. Therefore, even when it implements the best policy among the ones it has at its disposal, a distortion remains. However, we have shown that the mere act of choosing policy optimally over time reduces the size of the externality. This is true even if the optimal policy is to choose a tariff currently. By acting optimally, the government establishes credibility. A government cannot achieve credibility instantaneously -- it must do so over time by choosing the policy which is best for the public. The public will begin to recognize the benificence of the government, even if it is imposing a tariff, if that tariff is the best choice the government can make. (The irony is that the skepticism of the public is what forces the government to choose a tariff, and is what keeps the economy away from an unconstrained Pareto optimum.)

The presence of learning generally weakens the case for a tariff as a policy to deal with the intertemporal distortion caused by household's incredulity. First, the public must initially be more skeptical about the good intentions of the government (as compared to the case without learning) for it to be optimal to impose a tariff. Second, over time with learning it is inevitable that free trade becomes the best policy.

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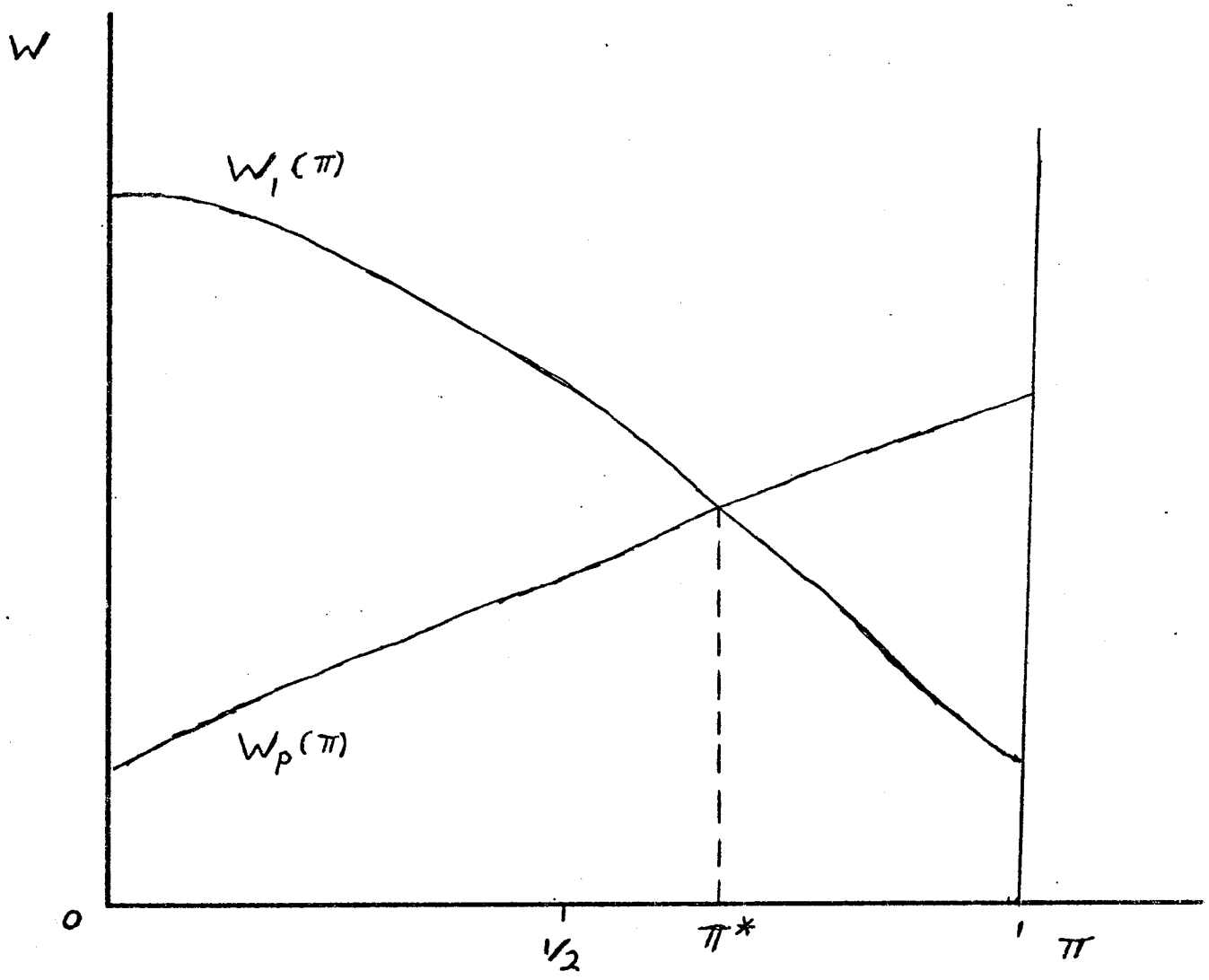
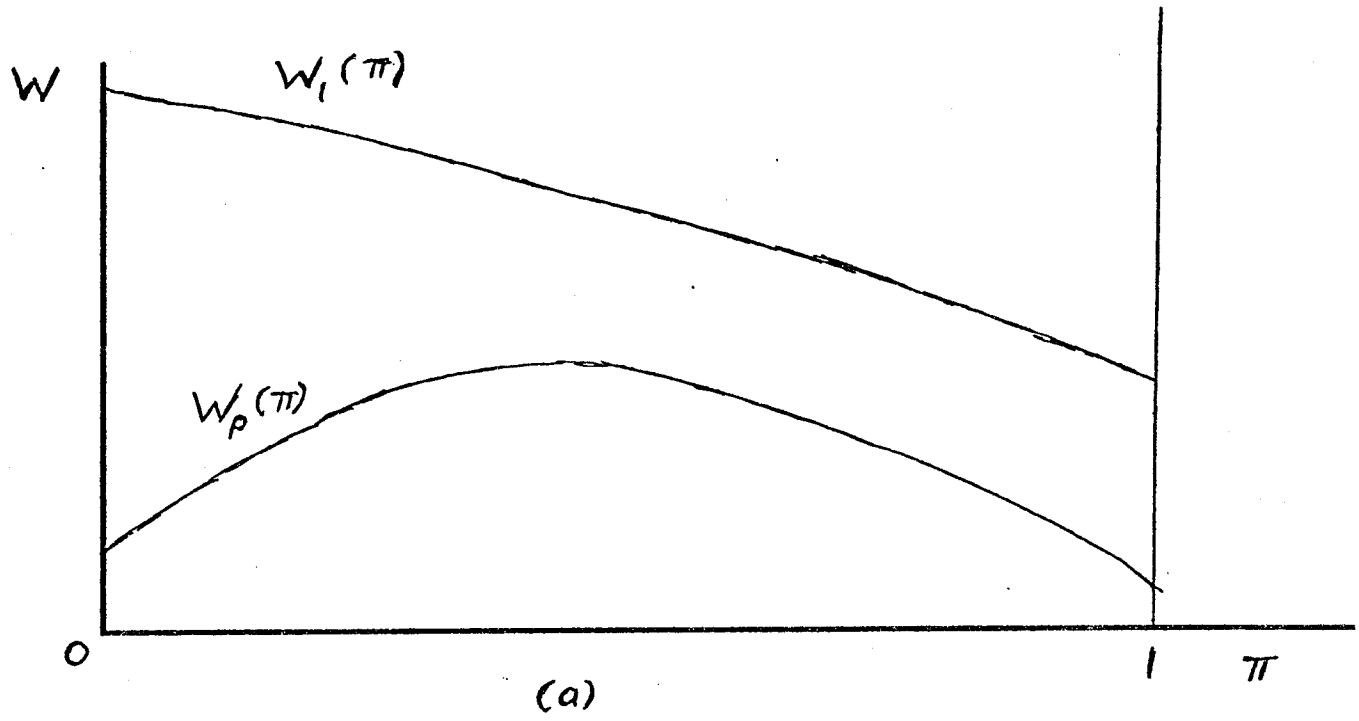
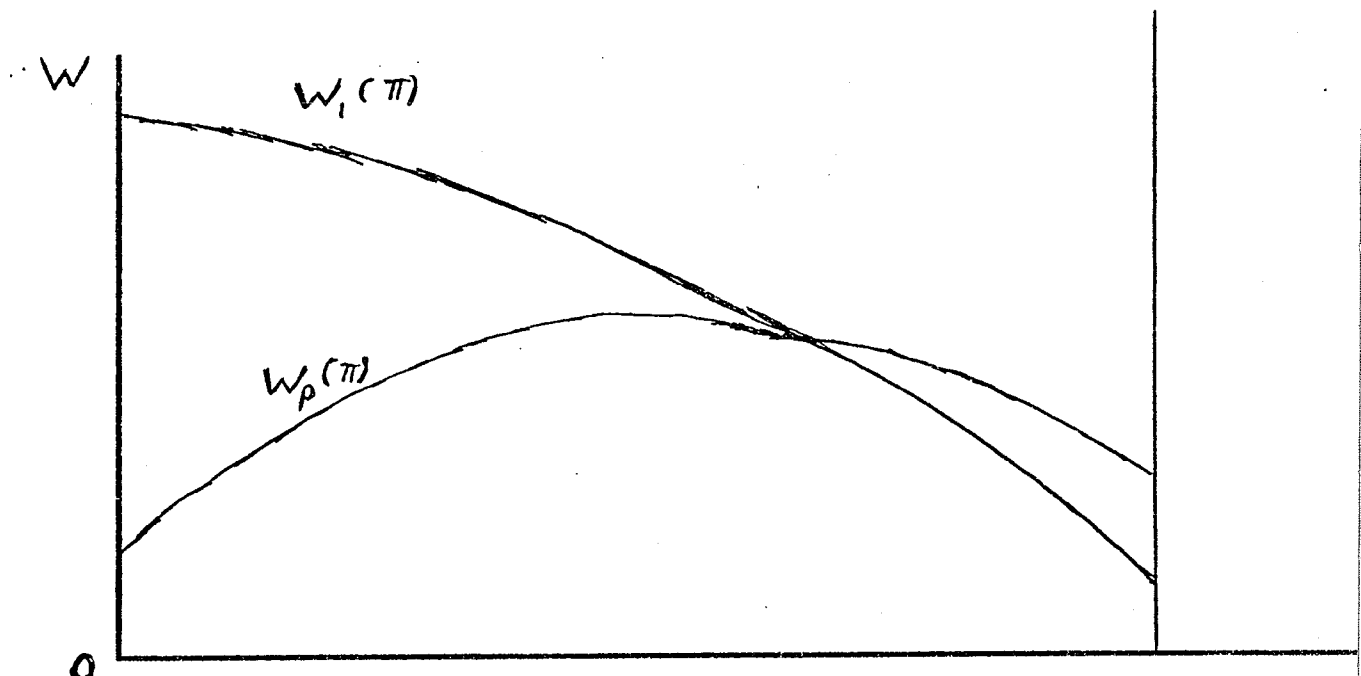


Figure 1



(a)



(b)

Figure 2